

INTRODUCTION

*The Science of Mind and Order**

The title of this book of collected essays and lectures is intended precisely to define the contents. The essays, spread over thirty-five years, combine to propose a new way of thinking about ideas and about those aggregates of ideas which I call "minds." This way of thinking I call the "ecology of mind," or the ecology of ideas. It is a science which does not yet exist as an organized body of theory or knowledge.

But the definition of an "idea" which the essays combine to propose is much wider and more formal than is conventional. The essays must speak for themselves, but here at the beginning let me state my belief that such matters as the bilateral symmetry of an animal, the patterned arrangement of leaves in a plant, the escalation of an armaments race, the processes of courtship, the nature of play, the grammar of a sentence, the mystery of biological evolution, and the contemporary crises in man's relationship to his environment, can only be understood in terms of such an ecology of ideas as I propose.

The questions which the book raises are ecological: How do ideas interact? Is there some sort of natural selection which determines the survival of some ideas and the extinction or death of others? What sort of economics limits the multiplicity of ideas in a given region of mind? What are the necessary conditions for stability (or survival) of such a system or subsystem?

Some of these questions are touched upon in the essays, but the main thrust of the book is to clear the way so that such questions can be meaningfully asked.

It was only in late 1969 that I became fully conscious of what I had been doing. With the writing of the Korzybski Lecture, "Form,

* This essay, written in 1971, has not been published elsewhere.

Substance, and Difference," I found that in my work with primitive peoples, schizophrenia, biological symmetry, and in my discontent with the conventional theories of evolution and learning, I had identified a widely scattered set of bench marks or points of reference from which a new scientific territory could be defined. These bench marks I have called "steps" in the title of the book.

In the nature of the case, an explorer can never know what he is exploring until it has been explored. He carries no Baedeker in his pocket, no guidebook which will tell him which churches he should visit or at which hotels he should stay. He has only the ambiguous folklore of others who have passed that way. No doubt deeper levels of the mind guide the scientist or the artist toward experiences and thoughts which are relevant to those problems which are somehow his, and this guidance seems to operate long before the scientist has any conscious knowledge of his goals. But how this happens we do not know.

I have often been impatient with colleagues who seemed unable to discern the difference between the trivial and the profound. But when students have asked me to define that difference, I have been struck dumb. I have said vaguely that any study which throws light upon the nature of "order" or "pattern" in the universe is surely nontrivial.

But this answer only begs the question.

I used to teach an informal course for psychiatric residents in the Veterans Administration Hospital at Palo Alto, trying to get them to think some of the thoughts that are in these essays. They would attend dutifully and even with intense interest to what I was saying, but every year the question would arise after three or four sessions of the class: "What is this course all about?"

I tried various answers to this question. Once I drew up a sort of catechism and offered it to the class as a sampling of the questions which I hoped they would be able to discuss after completing the course. The questions ranged from "What is a sacrament?" to "What is entropy?" and "What is play?"

As a didactic maneuver, my catechism was a failure: it silenced the class. But one question in it was useful:

A certain mother habitually rewards her small son with ice cream after he eats his spinach. What

additional information would you need to be able to predict whether the child will: a. Come to love or hate spinach, b. Love or hate ice cream, or c. Love or hate Mother?

We devoted one or two sessions of the class to exploring the many ramifications of this question, and it became clear to me that all the needed additional information concerned the context of the mother's and son's behavior. In fact, the phenomenon of context and the closely related phenomenon of "meaning" defined a division between the "hard" sciences and the sort of science which I was trying to build.

Gradually I discovered that what made it difficult to tell the class what the course was about was the fact that my way of thinking was different from theirs. A clue to this difference came from one of the students. It was the first session of the class and I had talked about the cultural differences between England and America—a matter which should always be touched on when an Englishman must teach Americans about cultural anthropology. At the end of the session, one resident came up. He glanced over his shoulder to be sure that the others were all leaving, and then said rather hesitantly, "I want to ask a question." "Yes." "It's—do you want us to learn what you are telling us?" I hesitated a moment, but he rushed on with, "Or is it all a sort of example, an illustration of something else?" "Yes, indeed!"

But an example of what?

And then there was, almost every year, a vague complaint which usually came to me as a rumor. It was alleged that "Bateson knows something which he does not tell you," or "There's something be-hind what Bateson says, but he never says what it is."

Evidently I was not answering the question, "An example of what?"

In desperation, I constructed a diagram to describe what I conceive to be the task of the scientist. By use of this diagram, it became clear that a difference between my habits of thought and those of my students sprang from the fact that they were trained to think and argue inductively from data to hypotheses but never to test hypotheses against knowledge derived by deduction from the fundamentals of science or philosophy.

The diagram had three columns. On the left, I listed various sorts of uninterpreted data, such as a film record of human or animal

behavior, a description of an experiment, a description or photograph of a beetle's leg, or a recorded human utterance. I stressed the fact that "data" are not events or objects but always records or descriptions or memories of events or objects. Always there is a transformation or recoding of the raw event which intervenes between the scientist and his object. The weight of an object is measured against the weight of some other object or registered on a meter. The human voice is transformed into variable magnetizations of tape. Moreover, always and inevitably, there is a selection of data because the total universe, past and present, is not subject to observation from any given observer's position.

In a strict sense, therefore, no data are truly "raw," and every record has been somehow subjected to editing and transformation either by man or by his instruments.

But still the data are the most reliable source of information, and from them the scientist must start. They provide his first inspiration and to them he must later return.

In the middle column, I listed a number of imperfectly defined explanatory notions which are commonly used in the behavioral sciences—"ego," "anxiety," "instinct," "purpose," "mind," "self," "fixed action pattern," "intelligence," "stupidity," "maturity," and the like. For the sake of politeness, I call these "heuristic" concepts; but, in truth, most of them are so loosely derived and so mutually irrelevant that they mix together to make a sort of conceptual fog which does much to delay the progress of science.

In the right-hand column, I listed what I call "fundamentals." These are of two kinds: propositions and systems of propositions which are truistical, and propositions or "laws" which are generally true. Among the truistical propositions I included the "Eternal Verities" of mathematics where truth is tautologically limited to the domains within which man-made sets of axioms and definitions obtain: "If numbers are appropriately defined and if the operation of addition is appropriately defined; then $5 + 7 = 12$." Among propositions which I would describe as scientifically or generally and empirically true, I would list the conservation "laws" for mass and energy, the Second Law of Thermodynamics, and so on. But the line between tautological truths and empirical generalizations is not sharply definable, and, among my "fundamentals," there are many propositions whose truth no

sensible man can doubt but which can-not easily be classified as either empirical or tautological. The "laws" of probability cannot be stated so as to be understood and not be believed, but it is not easy to decide whether they are empirical or tautological; and this is also true of Shannon's theorems in Information Theory.

With the aid of such a diagram, much can be said about the whole scientific endeavor and about the position and direction of any particular piece of inquiry within it. "Explanation" is the mapping of data onto fundamentals, but the ultimate goal of science is the increase of fundamental knowledge.

Many investigators, especially in the behavioral sciences, seem to believe that scientific advance is predominantly inductive and should be inductive. In terms of the diagram, they believe that progress is made by study of the "raw" data, leading to new heuristic concepts. The heuristic concepts are then to be regarded as "working hypotheses" and tested against more data. Gradually, it is hoped, the heuristic concepts will be corrected and improved until at last they are worthy of a place in the list of fundamentals. About fifty years of work in which thousands of clever men have had their share have, in fact, produced a rich crop of several hundred heuristic concepts, but, alas, scarcely a single principle worthy of a place in the list of fundamentals.

It is all too clear that the vast majority of the concepts of contemporary psychology, psychiatry, anthropology, sociology, and economics are totally detached from the network of scientific fundamentals.

Moliere, long ago, depicted an oral doctoral examination in which the learned doctors ask the candidate to state the "cause and reason" why opium puts people to sleep. The candidate triumphantly answers in dog Latin, "Because there is in it a dormitive principle (*virtus dormitiva*)."

Characteristically, the scientist confronts a complex interactive system—in this case, an interaction between man and opium. He observes a change in the system — the man falls asleep. The scientist then explains the change by giving a name to a fictitious "cause," located in one or other component of the interacting system. Either the opium contains a reified dormitive principle, or the man contains a

reified need for sleep, an adormitosis, which is "expressed" in his response to opium.

And, characteristically, all such hypotheses are "dormitive" in the sense that they put to sleep the "critical faculty" (another reified fictitious cause) within the scientist himself.

The state of mind or habit of thought which goes from data to dormitive hypothesis and back to data is self-reinforcing. There is, among all scientists, a high value set upon prediction, and, indeed, to be able to predict phenomena is a fine thing. But prediction is a rather poor test of an hypothesis, and this is especially true of "dormitive hypotheses." If we assert that opium contains a dormitive principle, we can then devote a lifetime of research to studying the characteristics of this principle. Is it heat-stable? In which fraction of a distillate is it located? What is its molecular formula? And so on. Many of these questions will be answerable in the laboratory and will lead on to derivative hypotheses no less "dormitive" than that from which we started.

In fact, the multiplication of dormitive hypotheses is a symptom of excessive preference for induction, and this preference must always lead to something like the present state of the behavioral sciences— a mass of quasi-theoretical speculation unconnected with any core of fundamental knowledge.

In contrast, I try to teach students— and this collection of essays is very much concerned with trying to communicate this thesis—that in scientific research you start from two beginnings, each of which has its own kind of authority: the observations cannot be denied, and the fundamentals must be fitted. You must achieve a sort of pincers maneuver.

If you are surveying a piece of land, or mapping the stars, you have two bodies of knowledge, neither of which can be ignored. There are your own empirical measurements on the one hand and there is Euclidean geometry on the other. If these two cannot be made to fit together, then either the data are wrong or you have argued wrongly from them or you have made a major discovery leading to a revision of the whole of geometry.

The would-be behavioral scientist who knows nothing of the basic structure of science and nothing of the 3000 years of careful philosophic and humanistic thought about man — who cannot define either entropy

or a sacrament —had better hold his peace rather than add to the existing jungle of half-baked hypotheses.

But the gulf between the heuristic and the fundamental is not solely due to empiricism and the inductive habit, nor even to the seductions of quick application and the faulty educational system which makes professional scientists out of men who care little for the fundamental structure of science. It is due also to the circumstance that a very large part of the fundamental structure of nineteenth-century science was inappropriate or irrelevant to the problems and phenomena which confronted the biologist and behavioral scientist.

For at least 200 years, say from the time of Newton to the late nineteenth century, the dominant preoccupation of science was with those chains of cause and effect which could be referred to forces and impacts. The mathematics available to Newton was preponderantly quantitative, and this fact, combined with the central focus upon forces and impacts, led men to measure with remarkable accuracy quantities of distance, time, matter, and energy.

As the measurements of the surveyor must jibe with Euclidean geometry, so scientific thought had to jibe with the great conservative laws. The description of any event examined by a physicist or chemist was to be founded upon budgets of mass and energy, and this rule gave a particular kind of rigor to the whole of thought in the hard sciences.

The early pioneers of behavioral science not unnaturally began their survey of behavior by desiring a similar rigorous base to guide their speculations. Length and mass were concepts which they could hardly use in describing behavior (whatever that might be), but energy seemed more handy. It was tempting to relate "energy" to already existing metaphors such as "strength" of emotions or character or "vigor." Or to think of "energy" as somehow the opposite of "fatigue" or "apathy." Metabolism obeys an energy budget (within the strict meaning of "energy"), and energy expended in behavior must surely be included in this budget; therefore it seemed sensible to think of energy as a determinant of behavior.

It would have been more fruitful to think of lack of energy as preventive of behavior, since in the end a starving man will cease to behave. But even this will not do: an amoeba, deprived of food, becomes for a time more active. Its energy expenditure is an inverse function of energy input.

The nineteenth-century scientists (notably Freud) who tried to establish a bridge between behavioral data and the fundamentals of physical and chemical science were, surely, correct in insisting upon the need for such a bridge but, I believe, wrong in choosing "energy" as the foundation for that bridge.

If mass and length are inappropriate for the describing of behavior, then energy is unlikely to be more appropriate. After all, energy is $\text{Mass} \times \text{Velocity}^2$, and no behavioral scientist really insists that "psychic energy" is of these dimensions.

It is necessary, therefore, to look again among the fundamentals for an appropriate set of ideas against which we can test our heuristic hypotheses.

But some will argue that the time is not yet ripe; that surely the fundamentals of science were all arrived at by inductive reasoning from experience, so we should continue with induction until we get a fundamental answer.

I believe that it is simply not true that the fundamentals of science began in induction from experience, and I suggest that in the search for a bridgehead among the fundamentals we should go back to the very beginnings of scientific and philosophic thought; certainly to a period before science, philosophy, and religion had become separate activities separately pursued by professionals in separate disciplines.

Consider, for example, the central origin myth of Judaeo-Christian peoples. What are the fundamental philosophic and scientific problems with which this myth is concerned?

In the beginning God created the heaven and the earth.
And the earth was without form, and void; and darkness was
upon the face of the deep. And the Spirit of God moved upon
the face of the waters.

And God said, Let there be light: and there was light. And God
saw the light, that it was good: and God divided the light from
the darkness. And God called the light Day, and the darkness he
called Night. And the evening and the morning were the first
day.

And God said, Let there be a firmament in the midst of the waters, and let it divide the waters from the waters. And God made the firmament, and divided the waters which were under the firmament from the waters which were above the firmament: and it was so. And God called the firmament Heaven. And the evening and the morning were the second day.

And God said, Let the waters under the heaven be gathered together unto one place, and let the dry land appear: and it was so. And God called the dry land Earth; and the gathering together of the waters called he Seas: and God saw that it was good.

Authorized version

Out of these first ten verses of thunderous prose, we can draw some of the premises or fundamentals of ancient Chaldean thought and it is strange, almost eerie, to note how many of the fundamentals and problems of modern science are foreshadowed in the ancient document.

(1) The problem of the origin and nature of matter is summarily dismissed.

(2) The passage deals at length with the problem of the origin of order.

(3) A separation is thus generated between the two sorts of problem. It is possible that this separation of problems was an error, but—error or not—the separation is maintained in the fundamentals of modern science. The conservative laws for matter and energy are still separate from the laws of order, negative entropy, and information.

(4) Order is seen as a matter of sorting and dividing. But the essential notion in all sorting is that some difference shall cause some other difference at a later time. If we are sorting black balls from white balls, or large balls from small balls, a difference among the balls is to be followed by a difference in their location—balls of one class to one sack and balls of another class to another. For such an operation, we need

something like a sieve, a threshold, or, par excellence, a sense organ. It is understandable, therefore, that a perceiving Entity should have been invoked to perform this function of creating an otherwise improbable order.

(5) Closely linked with the sorting and dividing is the mystery of classification, to be followed later by the extraordinary human achievement of naming.

It is not at all clear that the various components of this myth are all products of inductive reasoning from experience. And the matter becomes still more puzzling when this origin myth is compared with others which embody different fundamental premises.

Among the Iatmul of New Guinea, the central origin myth, like the Genesis story, deals with the question of how dry land was separated from water. They say that in the beginning the crocodile Kavwokmali paddled with his front legs and with his hind legs; and his paddling kept the mud suspended in the water. The great culture hero, Kevembuangga, came with his spear and killed Kavwokmali. After that the mud settled and dry land was formed. Kevembuangga then stamped with his foot on the dry land, i.e., he proudly demonstrated "that it was good."

Here there is a stronger case for deriving the myth from experience combined with inductive reasoning. After all, mud does remain in suspension if randomly stirred and does settle when the stirring ceases. Moreover, the Iatmul people live in the vast swamps of the Sepik River valley where the separation of land from water is imperfect. It is understandable that they might be interested in the differentiation of land from water.

In any case, the Iatmul have arrived at a theory of order which is almost a precise converse of that of the book of Genesis. In Iatmul thought, sorting will occur if randomization is prevented. In Genesis, an agent is invoked to do the sorting and dividing.

But both cultures alike assume a fundamental division between the problems of material creation and the problems of order and differentiation.

Returning now to the question of whether the fundamentals of science and/or philosophy were, at the primitive level, arrived at by inductive reasoning from empirical data, we find that the answer is not simple. It is difficult to see how the dichotomy between

substance and form could be arrived at by inductive argument. No man, after all, has ever seen or experienced formless and unsorted matter; just as no man has ever seen or experienced a "random" event. If, therefore, the notion of a universe "without form and void" was arrived at by induction, it was by a monstrous—and perhaps erroneous — jump of extrapolation.

And even so, it is not clear that the starting point from which the primitive philosophers took off was observation. It is at least equally likely that dichotomy between form and substance was an unconscious deduction from the subject-predicate relation in the structure of primitive language. This, however, is a matter beyond the reach of useful speculation.

Be that as it may, the central—but usually not explicit — subject matter of the lectures which I used to give to psychiatric residents and of these essays is the bridge between behavioral data and the "fundamentals" of science and philosophy; and my critical comments above about the metaphoric use of "energy" in the behavioral sciences add up to a rather simple accusation of many of my colleagues, that they have tried to build the bridge to the wrong half of the ancient dichotomy between form and substance. The conservative laws for energy and matter concern substance rather than form. But mental process, ideas, communication, organization, differentiation, pattern, and so on, are matters of form rather than substance.

Within the body of fundamentals, that half which deals with form has been dramatically enriched in the last thirty years by the discoveries of cybernetics and systems theory. This book is concerned with building a bridge between the facts of life and behavior and what we know today of the nature of pattern and order.

Part I: Metalogues

DEFINITION: A metalogue is a conversation about some problematic subject. This conversation should be such that not only do the participants discuss the problem but the structure of the conversation as a whole is also relevant to the same subject. Only some of the conversations here presented achieve this double format.

Notably, the history of evolutionary theory is inevitably a metalogue between man and nature, in which the creation and interaction of ideas must necessarily exemplify evolutionary process.